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**UTILITY  
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TRANSMITTAL**

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MITSUO NIIDA ET AL.

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**APPLICATION ELEMENTS**

See MPEP chapter 600 concerning utility patent application contents.

**ADDRESS TO:**Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 202311. ☒ Fee Transmittal Form  
(Submit an original, and a duplicate for fee processing)2. ☒ Specification Total Pages 3. ☒ Drawing(s) (35 USC 113) Total Sheets 4. ☐ Oath or Declaration Total Pages   
a. ☐ Newly executed (original or copy)  
b. ☐ Copy from a prior application (37 CFR 1.63(d))  
(for continuation/divisional with Box 17 completed)  
[Note Box 5 below]i. ☐ **DELETION OF INVENTOR(S)**  
Signed Statement attached deleting  
inventor(s) named in the prior application,  
see 37 CFR 1.63(d)(2) and 1.33(b).5. ☐ Incorporation By Reference (useable if Box 4b is checked)  
The entire disclosure of the prior application, from which a  
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accompanying application and is hereby incorporated by  
reference therein.6. ☐ Microfiche Computer Program (Appendix)7. Nucleotide and/or Amino Acid Sequence Submission  
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**ACCOMPANYING APPLICATION PARTS**8. ☐ Assignment Papers (cover sheet & document(s))9. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney10. ☐ English Translation Document (if applicable)11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations12. ☐ Preliminary Amendment13. ☒ Return Receipt Postcard (MPEP 503)  
(Should be specifically itemized)14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application  
Status still proper and desired15. ☐ Certified Copy of Priority Document(s)  
(if foreign priority is claimed)16. ☒ Other: Transmittal Letter Under 37 C.F.R. § 1.53 and  
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17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. \_\_\_\_/\_\_\_\_**18. CORRESPONDENCE ADDRESS**☐ Customer Number or Bar Code Label (Insert Customer No. or Attach bar code label here) or ☒ Correspondence address below

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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
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19. Small entity status

- a. ☐ A Small entity statement is enclosed
- b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
- c. ☐ Is no longer claimed.

20. ☒ A check in the amount of \$ 1,602.00 to cover the filing fee is enclosed.

21. ☐ A check in the amount of \$ \_\_\_\_\_ to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 06-1205:

- a. ☒ Fees required under 37 CFR 1.16.
- b. ☐ Fees required under 37 CFR 1.17.
- c. ☐ Fees required under 37 CFR 1.18.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED	
NAME	Abigail F. Cousins, Registration No. 29,292
SIGNATURE	<i>Abigail Cousins</i>
DATE	February 11, 1998

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
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MITSUO NIIDA ET AL.	)	
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Application No.: Unassigned	)	
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Assistant Commissioner for Patents  
Washington, D.C. 20231

TRANSMITTAL LETTER UNDER 37 C.F.R. § 1.53  
AND M.P.E.P. § 601.01

Sir:

Enclosed herewith for filing is a specification under 37 C.F.R. § 1.71; claims under 37 C.F.R. § 1.75; and drawings under 37 C.F.R. § 1.81 for a patent application for COMMUNICATION APPARATUS AND COMMUNICATION METHOD on behalf of the inventors under 37 C.F.R. § 1.41(c), MITSUO NIIDA, having a post office address of 190-1-413, Setogaya-cho, Hodogaya-ku, Yokohama-shi, Kanagawa-ken, Japan; SHINICHI HATAE, having a post office address of 817-76-305, Ogura, Saiwai-ku, Kawasaki-shi, Kanagawa-ken, Japan.

Priority is based upon Japanese Patent Application Nos. 9-030281 filed on February 14, 1997; 9-030286 filed on

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February 14, 1997; 10-028416 filed on February 10, 1998; and 10-028417 filed on February 10, 1998.

The undersigned is authorized to file the subject application on behalf of the inventor.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 758-2400. All correspondence should be directed to our below listed address.

Respectfully submitted,

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## BACKGROUND OF THE INVENTION

5           The present invention relates to a communication apparatus provided in an electronic device capable of transmitting and receiving information data via a digital interface, and a communication method of the apparatus.

Recently, apparatuses and systems for processing not only text information such as documents but also various information such as images and sounds are beginning to be extensively used with the improvement of the processing capability of a central processing unit (CPU) using a computer or the like, the progress of a graphical operating system (OS) for operating hardware, the increase in capacity and the progress of digitization of communication information in a network, and the development of information compression techniques.

With the development of such multimedia technologies, it is becoming possible to transmit all types of data in all forms by all communication protocols via a single digital interface (digital I/F). It is also becoming possible for an apparatus corresponding to one communication protocol and

incorporating a plurality of units to externally control each unit and exchange information with external devices.

As an example of the digital I/F bus systems described above, a communication system has been proposed in which AV devices, such as a digital video tape recorder (to be referred to as a VTR hereinafter), a digital television receiver, and a tuner, and a personal computer (to be referred to as a PC hereinafter) are mutually connected by an IEEE1394 serial bus (to be referred to as 1394 hereinafter), and digital video signals and digital audio signals are transmitted and received between these electronic devices. An outline of this 1394 system will be described below.

As shown in Fig. 1, the 1394 system includes, as digital devices, a PC and a VTR corresponding to VGA (Video Graphics Array) inputs from a digital I/F, and a digital camera (to be referred to as a DCAM hereinafter) and a digital cam coder (to be referred to as DVCR) corresponding to VGA outputs from a digital I/F. The DVCR and the PC, the PC and the VTR, and the VTR and the DCAM are connected by the 1394 serial bus described above.

Each digital device described above has a function of relaying digital data and control data on the 1394 serial bus. Also, a cable for the 1394 serial bus

includes three shielded twisted pair lines. Each twisted pair line is used to transfer protocol signals and data and supply electric power. Therefore, the whole system can operate even when a certain device is

5 turned off in the system.

The basic configuration of each digital device has an operation unit as a user interface, a display unit, a CPU for controlling the operation of the whole device, forming packets for communication, and holding addresses, a digital I/F for the 1394 serial bus, and a switch unit for performing switching between a deck unit, a tuner unit, or a camera unit (neither is shown) and the digital I/F.

In this 1394 system, as shown in Fig. 2,  
15 communication is performed at a predetermined  
communication cycle (125  $\mu$ s). Data having a time axis  
such as video data or audio data is transmitted by  
isochronous (synchronous) communication by which a  
transfer band is guaranteed at a fixed data rate.  
20 Control data such as a control command is transmitted  
irregularly, where necessary, by asynchronous  
communication.

In communication like this, a cycle start packet exists at the beginning of each communication cycle, and a period for transmitting a packet for isochronous communication is set subsequently to the cycle start packet. A plurality of channels of isochronous

communication can be simultaneously performed by assigning channel numbers to packets for isochronous communication.

For example, when channel 1 is assigned to communication from the DVCR to the VTR, the DVCR transmits an isochronous communication packet of channel number 1 onto the bus immediately after the cycle start packet. Meanwhile, the VTR monitors packets on the bus and receives the packet assigned with channel number 1. In this manner isochronous communication is executed between the DVCR and the VTR.

Analogously, when channel number 2 is assigned to a packet from the DCAM to the PC, isochronous communication is executed between the DCAM and the PC by transmitting the packet of channel number 2 onto the bus after the packet of channel number 1, and the isochronous communications between channel 1 and channel 2 are performed parallel. A period from the completion of transmission of all isochronous communication packets in each communication cycle to the next cycle start packet is used in asynchronous communication.

Bus management by which the 1394 serial bus system described above can operate will be described below.

25           An apparatus serving as a bus manager previously  
checks the network structure and the connection states  
of all nodes and controls bus communication by defining



each node ID and controlling isochronous communication.

That is, in the communication system as described above, when the power supply is turned on or when a new digital device is connected or a certain device is disconnected, node IDs (physical addresses #0, #1, #2, and #3 in Fig. 3) are automatically assigned to the individual devices (nodes) in accordance with their connection states by the following procedure based on an address program and an address table stored in an internal memory of the CPU, thereby automatically setting topology.

This node ID assignment procedure will be briefly described below. This procedure includes determination of the hierarchical structure of the system and assignment of physical addresses to the nodes.

Assume that the above digital devices, i.e., the PC, DVCR, VTR, and DCAM are nodes A, B, C, and D, respectively.

First, each node transmits to a partner node, to which this node is connected by the 1394 serial bus, information indicating that the partner is its parent. While giving priority to a node first transmitting this information to its partner, the parent-child relationship between the nodes in this system, i.e., the hierarchical structure of the system and a route node which is not a child of any other node are finally determined.

More specifically, the node D informs the node C that the partner is a parent, and the node B informs the node A that the partner is a parent. If the node A informs the node C that the partner is a parent and the node C informs the node A that the partner is a parent, a node which first transmits the information to its partner is given priority. That is, if the transmission from the node C is earlier, the node A is regarded as a parent of the node C. As a consequence, the node A is not a child of any other node. If this is the case, the node A is a route node.

After the parent-child relationship between the digital devices is thus determined, assignment of physical addresses is performed. This physical address assignment is basically done in such a manner that parent nodes permit child nodes to perform address assignment and these child nodes permit themselves to perform address assignment from one connected to the smaller port number.

When the parent-child relationship is determined as above in the example shown in Fig. 3, the node A first permits the node B to perform address assignment. As a consequence, the node B assigns physical address #0 to itself. The node B sends this information onto the bus to inform the other nodes that "physical address #0 is already assigned".

Next, the node A permits the node C to perform

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communication, the transmission source node starts data transfer by the designated channel immediately after receiving a cycle start packet transmitted by the route node as a cycle master in synchronism with the communication cycle. Note that the cycle master transmits the cycle start packet onto the bus and also matches the time of the individual nodes.

In the case of asynchronous communication in which control data such as a command is transferred, on the other hand, after synchronous transfer in each communication cycle is complete, arbitration for asynchronous communication is performed, and data transfer from the transmission source node and the transmission destination node is started.

In addition to the IEEE1394 standard described above, the RS-232C standard and the RS-422 standard presently exist and are used as the conventional serial data communication methods. These standards assume mutual connection using serial binary data exchange between a data terminal equipment (DTE) and a data circuit-terminating equipment (DCE). These standards are formed and open to the public by the American National Standards Institute (ANSI).

As another example of the digital I/F bus systems, a universal serial bus (to be referred to as a USB hereinafter) as defined in Universal Serial Bus Specification (Revision 1.0, January 15 1996) is

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proposed. This bus is invented as an external bus for connecting a PC and its peripheral devices. An outline of this USB system will be described below.

The connection form of the USB will be described with reference to Fig. 3. This USB system comprises a host computer 300 such as a PC, a route hub 302, a first device 304 which is a recording medium such as a hard disk, a composite device 306 such as a camera-integrated VTR, a first hub 308, a second device 310 such as a video camera, a third device 312 such as a VTR, a second hub 314, a fourth device 316 which is an input device such as a keyboard, and a fifth device 318 which is a pointing device such as a mouse. A hub has a function of adding a USB device. Also, a device is a terminal equipment including a USB bus interface (not shown). In this USB as shown in Fig. 3, the terminal equipments are connected via the hubs including the route hub 302 on the host computer 300, thereby forming a multiple star connection.

Since the host computer 300 has rights to access the first, second, third, and fourth devices 304, 310, 312, and 316, data exchange between these devices is performed via the host computer 300. Therefore, bus arbitration between the devices is not performed.

In the USB, data transfer is performed by a frame whose unit is  $1 \pm 0.05$  ms. Fig. 4 shows the structure of the frame in the USB. Packets are packed in this

frame in accordance with the purpose and transferred.

Four types of packets are defined in the USB. The

first one is a token packet, the second one is a

start-of-frame packet (to be referred to as an SOF

5 packet hereinafter), the third one is a data packet,

and the fourth one is a handshake packet. The frame is

started by the SOF packet.

The host computer 300 performs data transfer with

a plurality of devices by sequentially sending data

10 transfer requests previously scheduled in the frame.

If data is large-amount data, such as image data, which

cannot be contained in a single frame, the host

computer 300 divides the data in units of frames and

transfers the divided data.

15 Packet fields are packed in the above four types

of packets in accordance with the purpose and

transferred. In the USB, six types of packet fields

are defined. The first one is an 8-bit packet

identifier field (to be referred to as a PID

20 hereinafter), the second one is a 7-bit address field

(to be referred to as an ADDR hereinafter), the third

one is a 4-bit endpoint field (to be referred to as an

ENDP hereinafter), the fourth one is an 11-bit frame

number field, the fifth one is a 1- to 1023-byte data

25 field, and the sixth one is a 5- or 16-bit cyclic

redundancy checks field (the 5- and 16-bit ones will be

referred to as a CRC5 and a CRC16, respectively,

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Figs. 5A to 5D show the arrangements of the four types of packets. As shown in Fig. 5A, the token

5 packet is constituted by the combination of the PID,  
ADDR, ENDP, and CRC5 fields. As shown in Fig. 5B, the  
SOF packet is constituted by the combination of the  
PID, frame number, and CRC5 fields. As shown in  
Fig. 5C, the data packet is constituted by the  
10 combination of the PID, data, and CRC16 fields. As  
described above, the data field has 1- to 1023-byte  
data. Also, as shown in Fig. 5D, the handshake packet  
is constituted only by the PID.

In the USB, two transfer modes are defined. One  
15 is a full-speed transfer mode whose average bit rate is  
12 Mbps. The other is a low-speed transfer mode whose  
average bit rate is 1.5 Mbps.

Also, four data transfer methods are defined in the USB. The first one is isochronous transfer. In isochronous transfer, a transfer width which is a data amount of transfer performed for each frame and a transfer time from transfer request to transfer start are guaranteed. Also, in isochronous transfer, no retransmission request can be made even if an error occurs in transfer data. The second one is interrupt transfer. In interrupt transfer, only inputs from the individual devices to the host computer 300 are

possible. Also, in interrupt transfer, the data transfer priority order on the bus is comparatively high. The third one is bulk transfer. In bulk transfer, the data transfer priority order is the lowest of the four transfer methods. The fourth one is control transfer. Control transfer is performed to exchange setup data for setting up the individual devices.

The 1394 serial bus system and the USB described above are communication systems which have not been put into practical use until recently, and the conventional communication systems using RS-232C and RS-422 are still extensively used presently.

The present situation, therefore, is that all of digital devices corresponding to the 1394, digital devices corresponding to the USB, and digital devices corresponding to RS-232C and RS-422 coexist.

Accordingly, it is expected that apparatuses including the interfaces of both the 1394 and the USB which are main streams in recent years will be extensively demanded. It is also expected that apparatuses including both the 1394 interface and the interface of RS-232C or RS-422 will be extensively demanded. Furthermore, it is expected that apparatuses including a plurality of interfaces of, e.g., the 1394, the USB, and RS-232C will be extensively demanded.

If, however, two or more types of communication



devices are incorporated into a single apparatus to perform communication by two or more communication systems, the circuit scale is increased, and this significantly increases the cost.

5 SUMMARY OF THE INVENTION

The present invention has been made in consideration of the above situation, and has as its first object to provide a communication apparatus and a communication method capable of selecting two or more  
10 communication systems by using a single device without increasing the cost due to an increase in the circuit scale or deteriorating the operability in setting device connection.

To achieve the above object, according to one  
15 preferred embodiment of the present invention, there are provided a communication apparatus and a communication method of transmitting and receiving command data for controlling a device connected to a communication line by selecting an arbitrary one of a  
20 plurality of different communication systems, wherein at least some of a plurality of command data of each of the different communication systems are used in all of the communication systems.

According to another preferred embodiment of the  
25 present invention, there are provided a communication apparatus and a communication method of transmitting and receiving command data for controlling a device

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connected to a communication line by selecting an arbitrary one of a plurality of different communication systems and, on the basis of the received command data, generating control data for a device connected to the communication line, wherein at least some of a plurality of command data generated by each of the different communication systems are used in all of the communication systems.

According to still another preferred embodiment of the present invention, there are provided a communication apparatus and a communication method comprising a first communication mode which performs data communication on a first communication line on the basis of a first communication system, and a second mode which performs data communication on a second communication line on the basis of a second communication system different from the first communication system, wherein the communication modes are switched in accordance with a connection state with respect to the first communication line for the first communication system.

Other objects, features and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing the connection form of an



of a digital video camera using the data packet shown in Fig. 12.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first embodiment of the present invention will be described below with reference to the accompanying drawings. Fig. 6 is a block diagram showing the embodiment in which the present invention is applied to a video camera, i.e., a so-called SD (Standard Definition) video camera, for recording and reproducing an SD video signal.

Referring to Fig. 6, this SD video camera comprises a lens 1, an image sensing device 3 such as a CCD, a camera processing unit 5, a recording medium 7 such as a magnetic tape, a helical scan head (to be referred to as a head hereinafter) 9, an error correction circuit (to be referred to as an ECC hereinafter) 11, a video signal processing circuit 13, a switch circuit 15, an audio signal processing circuit 17, and a subcode data processing circuit 19.

The SD video camera further comprises an auxiliary data processing circuit (to be referred to as an AUX data processing circuit hereinafter) 21, an arithmetic processing unit (to be referred to as an MPU hereinafter) 23, a format circuit 25, an interface circuit (to be referred to as an I/F circuit hereinafter) 27, a read-only memory (to be referred to as a ROM hereinafter) 29, a 1394 driver 31, an RS-232C

driver 33, a 1394 I/O port 35, an RS-232C I/O port 37, a servo circuit 39, a data bus 41, and a mode controller 43.

5 An object image taken through the lens 1 is photoelectrically converted by the CCD 3 and subjected to predetermined signal processing by the camera processing unit 5. Consequently, a luminance signal Y and color difference signals V and U are generated at a ratio of 4 : 1 : 1 as digital video signals. These  
10 digital video signals thus generated are input to the switch circuit 15.

In performing encoding, the digital video signals are applied from the switch circuit 15 to the video signal processing circuit 13 under the switching  
15 control by the MPU 23. The video signal processing circuit 13 performs compression coding for the 4 : 1 : 1 digital video signals by block formation, discrete cosine transform (to be referred to as DCT hereinafter), quantization, and fixed-length coding.

20 Also, in performing encoding, a digital audio signal is input from a circuit (not shown) such as a microphone or an audio amplifier to the audio signal processing circuit 17 via the switch circuit 15 and encoded by the audio signal processing circuit 17.  
25 Additionally, subcode data and AUX data are input from the MPU 23 to the subcode data processing circuit 19 and the AUX data processing circuit 21, respectively,



and output outside via the switch circuit 15.  
Meanwhile, the subcode data processing circuit 19 and  
the AUX data processing circuit 21 connected to the  
data bus 41 input decoded subcode data and AUX data,  
5 respectively, to the MPU 23.

The compression-coded video and audio data are  
input to the format circuit 25 through the data bus 41.  
While the video signal processing circuit 13 and the  
audio signal processing circuit 17 are performing  
10 encoding, the input video and audio data to the format  
circuit 25 are data before the error correcting code is  
added by the ECC 11. On the other hand, while the  
video signal processing circuit 13 and the audio signal  
processing circuit 17 are performing decoding, the  
15 input video and audio data to the format circuit 25 are  
data after the error correcting code is removed by the  
ECC 11.

The output subcode data and AUX data from the MPU  
23 are also input to the format circuit 25. The format  
20 circuit 25 reconstructs these video data, audio data,  
subcode data, and AUX data into DIF data (digital  
interface data) and outputs these DIF data to the I/F  
circuit 27. These DIF data are packeted by the I/F  
circuit 27.

25 Note that the format circuit 25 and the I/F  
circuit 27 are so controlled by the MPU 23 as to  
perform processing suited to the selected one of the

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accordance with a setting signal (to be described later) sent from the MPU 23.

The servo circuit 39 controls the running of the magnetic tape 7 in accordance with a designation signal from the MPU 23. Note that the MPU 23 performs processing in accordance with input designating information from an operation panel (not shown) and manages the operation mode of the whole system of this digital VTR and its various status transitions.

This servo circuit 39 primarily has a function of stationarily maintaining the driving of a rotary drum and a capstan (neither is shown). That is, the servo circuit 39 is connected to a capstan motor (not shown) for controlling the tape feed speed, a capstan FG (Frequency Generator) for checking the rotating state of the capstan motor, a drum motor for rotating a rotary drum, and detectors FG and PG (Phase Generator) for checking the rotational speed and the rotational phase of the drum motor. These components are controlled by the servo circuit 39.

Command data for the SD video camera of this embodiment is externally applied to the 1394 I/O port 35. Figs. 7A and 7B are views showing general formats of the 1394 command data applied to the 1394 I/O port 35. Referring to Figs. 7A and 7B, CT and RC are 4-bit codes indicating a command type and a response code, respectively. Table 1 below shows codes of the command



[Table 2]

CT/RC code (binary)				Response code
MSB		LSB		
1	0	0	0	Conditions unfulfilled
1	0	0	1	Admitted
1	0	1	0	Rejected
1	0	1	1	Transiting
1	1	0	0	Conditions fulfilled/standby
1	1	0	1	Already changed
1	1	1	0	(Unused)
1	1	1	1	Busy

Referring to Figs. 7A and 7B, HA indicates a header address, and EHA indicates an extended header address. The header address is an 8-bit code and used as an identification code for a plurality of subdevices in one device connected to a communication interface (communication line). That is, the five upper bits of the header address indicate a subdevice type representing the type of the subdevice, and the three lower bits of the header address indicate a subdevice number representing the number of the subdevice among subdevices of the same type indicated by the five upper

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bits. The extended header address is a header address reserved for the future. Table 3 below shows examples of the subdevice type.

[Table 3]

Code (binary)					Subdevice type
MSB				LSB	
0	0	0	0	0	Video monitor
0	0	0	0	1	(Unused)
0	0	0	1	0	(Unused)
0	0	0	1	1	(Unused)
0	0	1	0	0	Video cassette recorder (VCR)
0	0	1	0	1	TV tuner
0	0	1	1	0	(Unused)
0	0	1	1	1	Video camera
0	1	0	0	0	(Unused)
		.			
		.			
		.			
1	1	1	1	1	

Referring to Figs. 7A and 7B, OPC indicates an operation code, and OPR indicates an operand. The operation code indicates the contents of control with respect to a digital device connected to a

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communication interface (communication line). The operand indicates data required by the operation code. Table 4 below shows examples of the operation code and operand for reproduction.

[Table 4]

OPC		OPR	
Reproduction	0xC3	Next frame	0x30
		Lowest rate	0x31
		Low rate 4	0x32
		Low rate 3	0x33
		Low rate 2	0x34
		Low rate 1	0x35
		Normal rate (x1)	0x36
		High rate 1	0x37
		High rate 2	0x35
		High rate 3	0x38
		High rate 4	0x39
		Highest rate	0x3A
		Preceding frame	0x3B

The unit of the data length of a command shown in Figs. 7A and 7B is four bytes. If the data length does not reach an integer multiple of four bytes, data in





connected in a one-to-one correspondence with each other. This makes device identification codes, device numbers, and the like data unnecessary. In this embodiment, therefore, a code such as "0xC336" is input to the RS-232C I/O port 37 to indicate the same normal reproduction. Table 5 below shows examples of the RS-232C reproduction codes corresponding to the 1394 control codes described above.

5

1997-1998		1998-1999		1999-2000		2000-2001		2001-2002		2002-2003		2003-2004		2004-2005		2005-2006		2006-2007		2007-2008		2008-2009		2009-2010		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016		2016-2017		2017-2018		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2028-2029		2029-2030		2030-2031		2031-2032		2032-2033		2033-2034		2034-2035		2035-2036		2036-2037		2037-2038		2038-2039		2039-2040		2040-2041		2041-2042		2042-2043		2043-2044		2044-2045		2045-2046		2046-2047		2047-2048		2048-2049		2049-2050		2050-2051		2051-2052		2052-2053		2053-2054		2054-2055		2055-2056		2056-2057		2057-2058		2058-2059		2059-2060		2060-2061		2061-2062		2062-2063		2063-2064		2064-2065		2065-2066		2066-2067		2067-2068		2068-2069		2069-2070		2070-2071		2071-2072		2072-2073		2073-2074		2074-2075		2075-2076		2076-2077		2077-2078		2078-2079		2079-2080		2080-2081		2081-2082		2082-2083		2083-2084		2084-2085		2085-2086		2086-2087		2087-2088		2088-2089		2089-2090		2090-2091		2091-2092		2092-2093		2093-2094		2094-2095		2095-2096		2096-2097		2097-2098		2098-2099		2099-2100		2100-2101		2101-2102		2102-2103		2103-2104		2104-2105		2105-2106		2106-2107		2107-2108		2108-2109		2109-2110		2110-2111		2111-2112		2112-2113		2113-2114		2114-2115		2115-2116		2116-2117		2117-2118		2118-2119		2119-2120		2120-2121		2121-2122		2122-2123		2123-2124		2124-2125		2125-2126		2126-2127		2127-2128		2128-2129		2129-2130		2130-2131		2131-2132		2132-2133		2133-2134		2134-2135		2135-2136		2136-2137		2137-2138		2138-2139		2139-2140		2140-2141		2141-2142		2142-2143		2143-2144		2144-2145		2145-2146		2146-2147		2147-2148		2148-2149		2149-2150		2150-2151		2151-2152		2152-2153		2153-2154		2154-2155		2155-2156		2156-2157		2157-2158		2158-2159		2159-2160		2160-2161		2161-2162		2162-2163		2163-2164		2164-2165		2165-2166		2166-2167		2167-2168		2168-2169		2169-2170		2170-2171		2171-2172		2172-2173		2173-2174		2174-2175		2175-2176		2176-2177		2177-2178		2178-2179		2179-2180		2180-2181		2181-2182		2182-2183		2183-2184		2184-2185		2185-2186		2186-2187		2187-2188		2188-2189		2189-2190		2190-2191		2191-2192		2192-2193		2193-2194		2194-2195		2195-2196		2196-2197		2197-2198		2198-2199		2199-2200		2200-2201		2201-2202		2202-2203		2203-2204		2204-2205		2205-2206		2206-2207		2207-2208		2208-2209		2209-2210		2210-2211		2211-2212		2212-2213		2213-2214		2214-2215		2215-2216		2216-2217		2217-2218		2218-2219		2219-2220		2220-2221		2221-2222		2222-2223		2223-2224	
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[Table 5]

Reproduction code	
Next frame	0xC330
Lowest rate	0xC331
Low rate 4	0xC332
Low rate 3	0xC333
Low rate 2	0xC334
Low rate 1	0xC335
Normal rate (×1)	0xC336
High rate 1	0xC337
High rate 2	0xC335
High rate 3	0xC338
High rate 4	0xC339
Highest rate	0xC33A
Preceding frame	0xC33B

When data is transferred by omitting the identification code and the device number of a device as described above, a delay time caused by command transfer can be reduced. This is convenient when RS-232C which is a relatively-low-rate interface is used.

When this code for normal reproduction is input to

the RS-232C I/O port 37, on the basis of this input code the I/F circuit 27 generates an address in the ROM 29 storing control data for normal reproduction and inputs the address to the MPU 23. In accordance with the generated address, the MPU 23 reads out the control data from the ROM 29 and controls the rotary drum and the capstan motor (neither is shown) via the servo circuit 39, thereby holding the reproduction state.

In the above embodiment, the command data applied to the 1394 I/O port 35 and the RS-232C I/O port 37 and having the same function are the same in the two communication systems. However, even when these command data are different, an increase in the circuit scale can be prevented by generating common control data in the two communication systems from the ROM 29 on the basis of the command data.

If this is the case, the I/F circuit 27 and the MPU 23 generate the same control data for command data received by the 1394 I/O port 35 and the RS-232C I/O port 37 by their respective communication systems and having the same function. That is, the I/F circuit 27 which generates addresses in the ROM 29 storing control data corresponding to the command data received by the I/O ports 35 and 37 generates the same address in the ROM 29 for the command data received by the two communication systems and having the same function.

The above embodiment is described by using the

IEEE1394 standard and the RS-232C standard. However, some other standard (e.g., the RS-422 standard) can also be used. Also, when common command data is used for not only a communication apparatus corresponding to two communication standards but also a communication apparatus corresponding to a larger number of communication standards, the communication apparatus can be manufactured without increasing the circuit scale.

In the above embodiment, the two lower bytes of the control command are the same in the IEEE1394 standard and the RS-232C standard. However, this common part can have another arrangement. Additionally, the code length for control is not limited to the above-mentioned code length (four bytes), so any arbitrary code length can be applied.

In this embodiment as described above, in an apparatus in which a given one of a plurality of different communication systems is selected to transmit and receive command data for controlling devices connected to a communication line, at least some of a plurality of command data of the different communication systems or of a plurality of device control data generated on the basis of the received command data are used in all of these communication systems. Therefore, a common communication apparatus for performing various control operations by

interpreting the command data or the control data can be used in the different communication systems. That is, it is unnecessary to provide a plurality of communication apparatuses for the different communication systems in one device. Consequently, it is possible to provide a communication apparatus which can select two or more different communication systems and does not largely increase the cost due to an increase in the circuit scale.

10       The automatic interface switching will be described below.

As described above, the 1394 driver 31 inputs the 1394 connection state data to the MPU 23 in addition to the control data from the 1394 serial bus. If data indicating that the 1394 serial bus is connected is input, the MPU 23 supplies a 1394 setting signal to the mode controller 43 in order to set the communication mode in the 1394 mode. Upon receiving the 1394 setting signal, the mode controller 43 holds the 1394 driver 31 active and holds the RS-232C driver 33 in sleep.

On the other hand, if the 1394 driver 31 is disconnected from the 1394 serial bus, the power supply voltage of the power supply twisted pair line of the 1394 twisted pair lines drops. The 1394 driver 31 detects this voltage drop and outputs to the MPU 23 data indicating that the 1394 driver 31 is disconnected from the 1394 serial bus. Upon receiving this 1394

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connection state data, the MPU 23 supplies an RS-232C setting signal to the mode controller 43 in order to set the communication mode in the RS-232C mode. When this RS-232C setting signal is input, the mode  
5 controller 43 sets the 1394 driver 31 in sleep and the RS-232C driver 33 active.

Fig. 8 is a flow chart showing the flow of interface switching control. Referring to Fig. 8, the control is started from step 0. In step 1, the  
10 communication mode is reset to the 1394 mode. In step 2, the 1394 driver 31 is set active. In step 3, the RS-232C driver 33 is set in sleep.

In step 4, the level of the power supply voltage of the power supply twisted pair line of the 1394  
15 twisted pair lines is compared with a threshold voltage  $Th$  previously determined in the system to check whether the power supply voltage is higher than the threshold voltage  $Th$ . This threshold voltage  $Th$  is set to, e.g., 4 V.

20 If the power supply voltage of the power supply twisted pair line of the 1394 twisted pair lines is higher than the threshold voltage  $Th$ , the flow returns to step 2. If this is the case, the processes in steps 2 to 4 form a loop to hold the 1394 driver 31 active  
25 and the RS-232C driver 33 in sleep.

On the other hand, if it is determined in step 4 that the power supply voltage of the power supply

twisted pair line of the 1394 twisted pair lines is lower than the threshold voltage  $T_h$ , the flow advances to step 5. In step 5, the 1394 driver 31 is set in sleep. In step 6, the RS-232C driver 33 is set active. In step 7, the communication mode is set in the RS-232C mode. In final step 8, the control is completed.

Although not shown in the flow chart of Fig. 8, in this embodiment the power supply voltage of the power supply twisted pair line of the 1394 twisted pair lines is measured at fixed time intervals. If this measured power supply voltage is higher than the threshold voltage  $T_h$  previously set in the system, the control start routine in step 0 is started. Therefore, even after the communication mode is set in the RS-232C mode, if the 1394 driver 31 is again connected to the 1394 serial bus, the communication mode is automatically switched to the 1394 mode.

In this embodiment as described above, it is unnecessary to provide a plurality of communication apparatuses for various communication systems in one digital device. Therefore, a digital device corresponding to two communication systems of the 1394 and RS-232C can be manufactured without increasing the circuit scale.

In this embodiment, data communication is performed in the 1394 communication mode when the 1394 driver 31 is connected to the 1394 serial bus. When

the 1394 serial bus is disconnected, the RS-232C driver 33 is automatically activated to perform data communication in the RS-232C communication mode.

Therefore, even when a plurality of devices are  
5 connected to both the 1394 serial bus and the RS-232C data channel, no connection setting operation need be performed, and high operability can be realized.

Although the above embodiment is described by using the IEEE1394 standard and the RS-232C standard,  
10 another standard (e.g., the RS-422 standard) can also be used in place of the RS-232C standard.

Alternatively, a communication line of any other standard than the IEEE1394 standard can be used, provided that the channel has a function of supplying  
15 power.

The second embodiment according to the present invention will be described below with reference to the accompanying drawings. Fig. 9 is a block diagram showing the embodiment in which the present invention  
20 is applied to a video camera, i.e., a so-called SD (Standard Definition) camera, for recording and reproducing an SD video signal. The second embodiment differs from the first embodiment in that the first embodiment includes the IEEE1394 and RS-232C as digital  
25 interfaces, but the second embodiment includes the IEEE1394 and the USB. That is, this embodiment discloses an apparatus in which at least some of

command data or of a plurality of device control data generated on the basis of the received command data are used in communication systems of both the 1394 and the USB. The same reference numerals as in Fig. 6 denote the same parts in Fig. 9, and a detailed description thereof will be omitted.

Referring to Fig. 9, this apparatus comprises a bit inversion circuit 45, a USB driver 47, and a USB I/O port 49.

Video and audio DIF data are directly input from a data bus 41 to a format circuit 25'. The format circuit 25' also receives subcode data and AUX data from an MPU 23, converts the data into DIF data, and outputs the DIF data. This DIF data is packeted by an I/F circuit 27'.

The format circuit 25' and the I/F circuit 27' are so controlled as to perform processing suited to one of the 1394 interface and the USB interface selected by the MPU 23.

When the 1394 interface is to be used, data is supplied to a 1394 I/O port 35 via a 1394 driver 31. When the USB interface is to be used, data is supplied to the bit inversion circuit 45, the USB driver 47, and the USB I/O port 49.

The 1394 and the USB transmit data by using different bit output methods; i.e., the most significant bit is transmitted first (MSB first) in the



1394, and the least significant bit is output first (LSB first) in the USB. When the USB is used, therefore, the bit inversion circuit 45 performs bit inversion for data to be transmitted and received. In this embodiment, bit inversion is performed for data to be transmitted and received by the USB on the basis of the 1394. However, bit inversion can also be performed for data to be transmitted and received by the 1394 on the basis of the USB.

10           The 1394 interface and the USB interface can be switched by the user by using an external select switch or can also be automatically switched by detecting the connections of these interfaces.

15           The automatic interface switching will be described later.

          As shown in the first embodiment, a code such as "0x0021C336" is input from an external device when the user intends to cause a VCR to perform normal reproduction.

20           When this normal reproduction code is input from the 1394 I/O port 35, on the basis of the input code the I/F circuit 27' generates an address in a ROM 29 storing data for normal reproduction and applies the address to the MPU 23. In accordance with this address data, the MPU 23 reads out the control data from the ROM 29 and controls a rotary drum and a capstan motor (neither is shown) via a servo circuit 39, thereby

holding the reproduction state.

On the other hand, when the user intends to perform normal reproduction in the same manner as above by using the USB, a code is transmitted from a host (not shown) by the bulk transfer described earlier. In the bulk transfer, a token packet as shown in Fig. 10A is transmitted in the start frame of the bulk transfer. In the next frame, the host transmits a data packet as shown in Fig. 10B. A code such as 0x0021C336 described above is contained in a data field of this data packet. Transmission of such comparatively small data is complete by two frames because data up to 1,023 bytes can be contained in the data field.

[Table 6] PIDs of token packet

PID name	PID value
OUT	11100001 <sub>2</sub>
IN	01101001 <sub>2</sub>
SETUP	00101101 <sub>2</sub>

[Table 7] PIDs of data packet

PID name	PID value
DATA0	11000011 <sub>2</sub>
DATA1	01001011 <sub>2</sub>

The PIDs in the token packet will be described



When the transmission from the host is complete, the SD video camera of this embodiment informs the host of the completion of the transmission by using a handshake packet as shown in Fig. 11. This handshake packet is constituted only by PID and changes the meaning of information in accordance with the value of the PID. Table 8 below shows the values of the PID. ACK indicates that the communication is normally complete. NACK indicates that the data from the host has an error. If this is the case, the host repeats the same data transfer as above. STALL indicates that the SD video camera of this embodiment is made unable to perform data transmission/reception for some reason.

[Table 8] PIDs of handshake packet

PID name	PID value
ACK	11010010 <sub>2</sub>
NACK	01011010 <sub>2</sub>
STALL	00011110 <sub>2</sub>

When informed by ACK that the communication is normally completed, the host again transmits the token packet to the SD video camera of this embodiment in order to receive a response code. In the next frame, the SD video camera of this embodiment inserts, e.g., a response code 0x0921C336, indicating that normal reproduction is possible, into a data packet and

transmits the data packet. When normally receiving the data packet, the host transmits the ACK handshake packet to the SD video camera of this embodiment to complete one transmission/reception.

5           In this embodiment, the control code and the response code are exchanged by using only bulk transfer. However, USB interrupt transfer can also be used in transmitting the response code. This configuration has the advantage that the response code  
10       can be reliably returned even if the data amount on the communication line is increased, since interrupt transfer has a higher transfer priority order than that of bulk transfer. Also, isochronous transfer can be used instead of bulk transfer in exchanging the control  
15       code and the response code.

          USB communication can also be performed by adding additional information to a data packet for performing the communication. Fig. 12 shows a whole data packet when the additional information is added, and the  
20       arrangement of a data field in the data packet. This data packet is transmitted by, e.g., isochronous transfer. During the transmission, the data field of the data packet is transmitted by a fixed length from the start to the end of the communication.

25           In the data field shown in Fig. 12, a field to be transmitted first is a data\_length field. The data length of the data\_length field is set to, e.g., 1

byte. This field indicates an effective data length  
contained in the data field in units of bytes. A  
fixed\_length\_data\_field follows the data\_length field.  
This field is a fixed-length data field as described  
5 above. This field includes a valid\_data field  
containing effective data to be actually decoded and a  
zero\_pad\_byte field in which data whose value is 0 is  
packed. If the data length of the valid\_data field  
equals the data length of the fixed\_length\_data\_field,  
10 the zero\_pad\_byte field does not exist in the  
fixed\_length\_data\_field. The value of the  
zero\_pad\_byte field is not limited to zero, and some  
other data such as 0xFF can also be used. The data  
length of the fixed\_length\_data\_field is set to, e.g.,  
15 15 bytes.

In the data field shown in Fig. 12, an RS\_code  
field to be transmitted last is an error  
detecting·correcting code such as a Reed-Solomon code.  
Although a Reed-Solomon code is used in this  
20 embodiment, another error detecting·correcting code  
such as a Humming code can also be used. In this  
embodiment, a Reed-Solomon code having, e.g., 8 bytes  
is added.

Fig. 13 is a block diagram in which a  
25 communication apparatus using the data packet shown in  
Fig. 12 is applied to an SD video camera. The same  
reference numerals as in Fig. 9 denote the same parts

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in Fig. 13, and a detailed description thereof will be omitted. Referring to Fig. 13, this SD video camera comprises a second error correcting circuit (ECC) 51 and a second data bus 53.

5           When normal reproduction is to be performed, a code in which the value of the valid\_data field in the data field shown in Fig. 12 is 0x0021C336 is applied from an external device to the USB driver 47 via the USB I/O port 49. Since the effective data length is  
10       set to four bytes, the value of the data\_length field is 0x04. In fact, the value of the above data is bit-inverted in units of bytes. The bit inversion circuit 45 converts this bit-inverted value into a normal value. Each converted data is supplied to the  
15       second error correcting circuit 51 through the second data bus 53, and errors occurring on the communication line are detected and corrected. In this embodiment, 4-byte correction is possible.

          With the above arrangement, even in isochronous  
20       transfer in which a retransmission request cannot be made by NACK, the accuracy of data in communication can be increased. Also, the use of isochronous transfer having a comparatively high priority order has the advantage that the response can be rapidly performed in  
25       exchanging data. Note that the data format described above can contain not only the data length and the error detecting·correcting code but also some other

additional information. Note also that the numbers of bytes of the data\_length field, the fixed\_length\_data\_field, and the RS\_code field are not limited to those of the above arrangement, so another arrangement can naturally be used. Furthermore, although isochronous transfer is used in this embodiment, the above arrangement is applicable to another transfer system such as bulk transfer.

The automatic interface switching will be described next.

As described in the first embodiment, the 1394 driver 31 monitors the connection of the 1394 by detecting the power supply voltage of a power supply twisted pair line of 1394 twisted pair lines, and outputs the connection state to the MPU 23. The USB driver 47 also monitors the connection of the USB from the signal statuses of USB twisted pair lines and outputs the connection state to the MPU 23.

First, connection switching when the 1394 driver 31 is the master will be described. In this case, 1394 connection is performed as much as possible. The 1394 driver 31 applies a control signal from the 1394 bus and the 1394 connection state data described earlier to the MPU 23. While the 1394 driver 31 is applying to the MPU 23 the data indicating that the 1394 bus is connected, the MPU 23 holds the 1394 driver 31 active in order to set the communication mode in the 1394



mode. Also, upon receiving this 1394 setting signal, the MPU 23 holds the USB driver 47 in sleep.

When the 1394 driver 31 is disconnected from the 1394 bus, the power supply voltage of the power supply twisted pair line of the 1394 twisted pair lines drops. The 1394 driver 31 detects this voltage drop and outputs to the MPU 23 data indicating that the 1394 driver 31 is disconnected from the 1394 bus. When receiving this data, the MPU 23 sets the 1394 driver 31 in sleep and the USB driver 47 active.

Next, connection switching when the USB driver 47 is the master will be described. In this case, USB connection is performed as much as possible. The USB driver 47 applies a control signal from the USB bus and the USB connection state data described previously to the MPU 23. The USB bus signal operates as differential signals. The differential signals are D+ and D-. When the USB driver 47 is connected to the USB bus, one of the D+ and D- holds a voltage higher than a maximum value  $V_{SE}(MAX)$  of a single-end threshold, and the other has a voltage lower than  $V_{SE}(MAX)$ . The USB driver 47 detects this state and applies data indicating USB bus connection to the MPU 23. While the USB driver 47 is inputting, to the MPU 23, the data indicating that the USB bus is connected, the MPU 23 holds the USB driver 47 active in order to set the communication mode in the USB mode. Also, upon

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receiving this USB setting signal, the MPU 23 holds the 1394 driver 31 in sleep.

When the USB driver 47 is disconnected from the USB bus, the voltages of both D+ and D- become lower than the voltage  $V_{SE}(MAX)$ . If this state continues for 2.5  $\mu$ sec or longer, the USB driver 47 determines that the connection is cut. The USB driver 47 outputs, to the MPU 23, data indicating that the USB driver 47 is disconnected from the USB bus. Upon receiving this data, the MPU 23 sets the communication mode in the 1394 mode. Also, the MPU 23 sets the USB driver 47 in sleep and the 1394 driver 31 active.

The switching performed to set the 1394 or the USB as the master can also be performed by the user by using a switch (not shown) or the like. Also, the 1394 can be set as the master by a standard operation, and this can be reset when the power supply is turned on. Alternatively, the USB can be set as the master by a standard operation, and this can be reset when the power supply is turned on. Any arbitrary setting can be performed as long as the apparatus operates as above.

The above embodiments have been described by using two digital I/Fs. However, the present invention is similarly applicable to an apparatus including three or more digital I/Fs such as the IEEE1394, the USB, and RS-232C.

In other words, the foregoing description of embodiments has been given for illustrative purposes only and not to be constructed as imposing any limitation in every respect.

5           The scope of the invention is, therefore, to be determined solely by the following claims and not limited by the text of the specifications and alterations made within the scope equivalent to the scope of the claims fall within the true spirit and  
10       scope of the invention.

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receiving command data for controlling a device  
connected to a communication line by selecting an  
arbitrary one of a plurality of different communication  
systems and, on the basis of the received command data,  
5 generating control data for a device connected to said  
communication line, wherein

at least some of a plurality of command data  
generated by each of said different communication  
systems are used in all of said communication systems.

10

7. A method according to claim 6, wherein said  
different communication systems include a communication  
system based on an IEEE1394 standard.

15

8. A method according to claim 6, wherein said  
different communication systems include a communication  
system based on an RS-232C standard.

20

9. A method according to claim 6, wherein said  
different communication systems include a communication  
system based on an RS-422 standard.

25

10. A method according to claim 6, wherein said  
different communication systems include a communication  
system based on a USB standard.

11. A communication apparatus comprising:

a) a plurality of communicating means provided in a one-to-one correspondence with a plurality of different communication systems to transmit and receive command data for controlling a device connected to a communication line; and

b) decoding means for decoding the command data received by said plurality of communicating means and controlling a device connected to said communication line,

wherein said decoding means generates common control data for command data received by said plurality of communicating means by respective communication systems thereof and having the same function.

12. An apparatus according to claim 11, wherein said decoding means comprises storage means for storing, in advance, the control data for controlling a device connected to said communication line, and address generating means for generating an address in said storage means storing the control data, in accordance with the command data received by said plurality of communicating means, and

said address generating means generates the same address in said storage means for the command data received by said plurality of communicating means by respective communication systems thereof and having the

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same function.

13. An apparatus according to claim 11, wherein  
the command data received by said plurality of  
5 communicating means by respective communication systems  
thereof and having the same function use the same code  
data.

14. An apparatus according to claim 11, wherein  
10 said plurality of communicating means include  
communicating means based on an IEEE1394 standard.

15. An apparatus according to claim 14, wherein  
said plurality of communicating means include  
15 communicating means based on an RS-232C standard.

16. An apparatus according to claim 14, wherein  
said plurality of communicating means include  
communicating means based on an RS-422 standard.  
20

17. An apparatus according to claim 14, wherein  
said plurality of communicating means include  
communicating means based on a USB standard.

25 18. A communication apparatus comprising:

a) a plurality of communicating means provided in  
a one-to-one correspondence with a plurality of

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different communication systems to transmit and receive command data for controlling a device connected to a communication line; and

5       b) supply means for supplying the command data to said plurality of communicating means,

          wherein at least some of a plurality of command data, supplied by said supply means, of each of said different communication systems are used in all of said communication systems.

10

          19. An apparatus according to claim 18, wherein said plurality of communicating means include communicating means based on an IEEE1394 standard.

15

          20. An apparatus according to claim 19, wherein said plurality of communicating means include communicating means based on an RS-232C standard.

20

          21. An apparatus according to claim 19, wherein said plurality of communicating means include communicating means based on an RS-422 standard.

25

          22. An apparatus according to claim 19, wherein said plurality of communicating means include communicating means based on a USB standard.

          23. A communication apparatus comprising:



a) a plurality of communicating means provided in a one-to-one correspondence with a plurality of different communication systems to transmit and receive command data for controlling a device connected to a communication line; and

b) decoding means for decoding the command data received by said plurality of communicating means and controlling a device connected to said communication line,

wherein said plurality of communicating means comprise at least first communicating means capable of transmitting and receiving N command data and second communicating means capable of transmitting and receiving M command data, and at least some of the M command data are included in the N command data.

24. An apparatus according to claim 23, wherein said plurality of communicating means include communicating means based on an IEEE1394 standard.

25. An apparatus according to claim 24, wherein said plurality of communicating means include communicating means based on an RS-232C standard.

26. An apparatus according to claim 24, wherein said plurality of communicating means include communicating means based on an RS-422 standard.

27. An apparatus according to claim 24, wherein said plurality of communicating means include communicating means based on a USB standard.

5 28. A communication apparatus comprising:

a) first communicating means for performing data communication in accordance with a first communication system;

10 b) second communicating means for performing data communication in accordance with a second communication system different from said first communication system;

c) first detecting means for detecting a connection state of said first communicating means with respect to a communication line; and

15 d) control means for controlling switching between said first and second communicating means in accordance with an output from said first detecting means.

20 29. An apparatus according to claim 28, wherein said first communicating means comprises power supply means for supplying power.

25 30. An apparatus according to claim 29, wherein said first detecting means detects the connection state of said first communicating means by measuring a power supply voltage of said power supply means.

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31. An apparatus according to claim 30, wherein  
said first detecting means measures the power supply  
voltage of said power supply means at predetermined  
time intervals and detects the connection state of said  
5 first communicating means in accordance with the  
measurement result.

32. An apparatus according to claim 28, wherein  
said plurality of communicating means include  
10 communicating means based on an IEEE1394 standard.

33. An apparatus according to claim 32, wherein  
said plurality of communicating means include  
communicating means based on an RS-232C standard.  
15

34. An apparatus according to claim 32, wherein  
said plurality of communicating means include  
communicating means based on an RS-422 standard.

20 35. An apparatus according to claim 32, wherein  
said plurality of communicating means include  
communicating means based on a USB standard.

36. An apparatus according to claim 32, wherein  
25 said second communicating means performs a differential  
operation.

37. An apparatus according to claim 28, further comprising:

second detecting means for detecting a connection state of said second communicating means with respect  
5 to a communication line,

wherein said control means controls switching between said first and second communicating means in accordance with an output from said first detecting means or an output from said second detecting means.  
10

38. An apparatus according to claim 37, wherein said second communicating means comprises power supply means for supplying power.

39. An apparatus according to claim 38, wherein said second detecting means detects the connection state of said second communicating means by measuring a power supply voltage of said power supply means.  
15

40. An apparatus according to claim 39, wherein said second detecting means measures the power supply voltage of said power supply means at predetermined time intervals and detects the connection state of said second communicating means in accordance with the measurement result.  
20  
25

41. An apparatus according to claim 37, wherein

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said second detecting means detects the connection state of said second communicating means in accordance with a voltage level on a signal line of a communication line.

42. A communication method comprising:

a first communication mode which performs data communication on a first communication line on the basis of a first communication system, and a second mode which performs data communication on a second communication line on the basis of a second communication system different from said first communication system,

wherein said communication modes are switched in accordance with a connection state with respect to said first communication line for said first communication system.

## ABSTRACT OF THE DISCLOSURE

10           This invention provides a communication apparatus  
and a communication method of transmitting and  
receiving command data for controlling a device  
connected to a communication line by selecting an  
arbitrary one of a plurality of different communication  
15 systems and, on the basis of the received command data,  
generating control data for a device connected to the  
communication line, wherein at least some of a  
plurality of command data generated by each of the  
different communication systems are used in all of the  
20 communication systems.

This invention provides a communication apparatus and a communication method including a first communication mode which performs data communication on a first communication line on the basis of a first communication system, and a second mode which performs data communication on a second communication line on the basis of a second communication system different

from the first communication system, wherein the communication modes are switched in accordance with a connection state with respect to the first communication line for the first communication system.

FIG.1

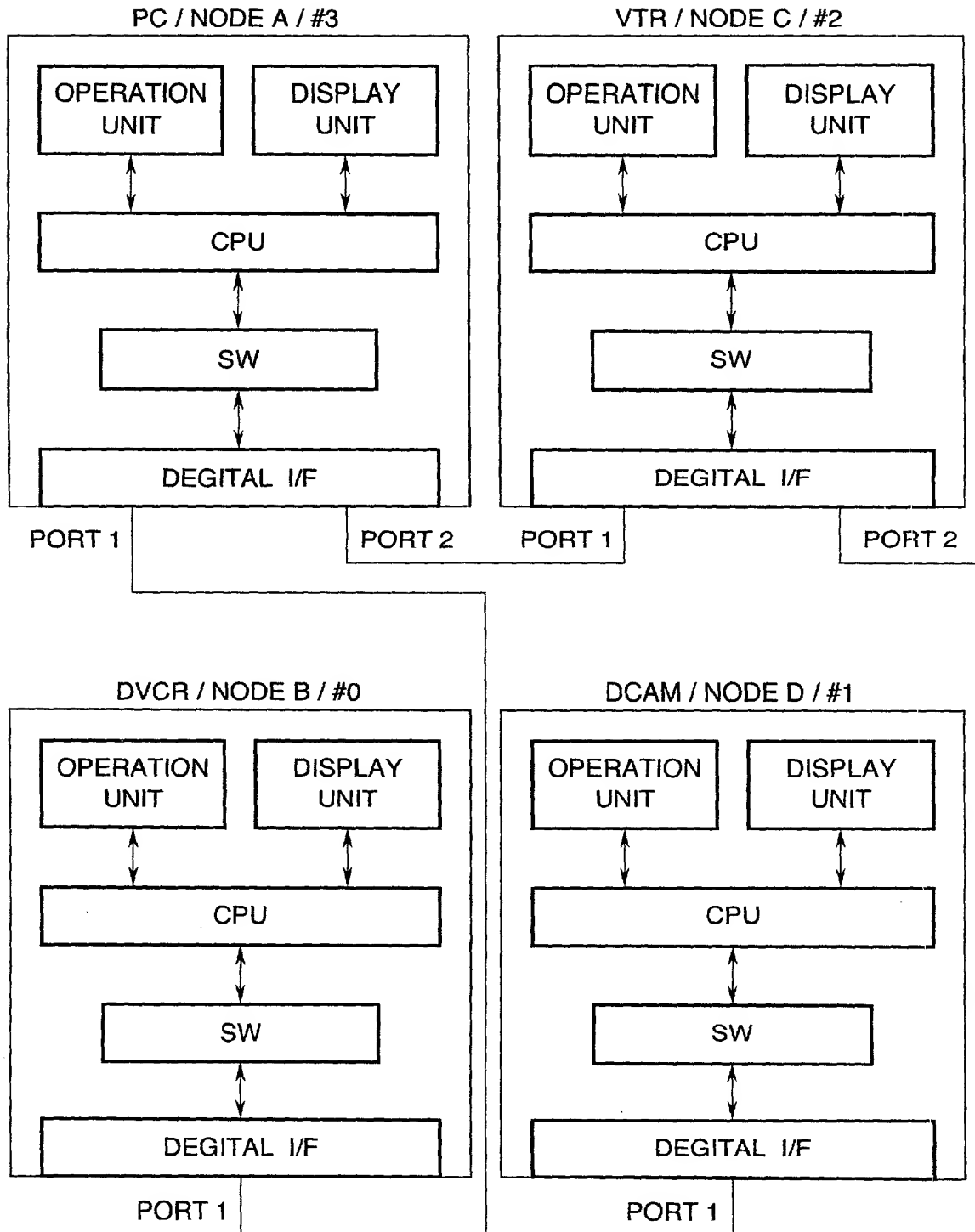




FIG.2

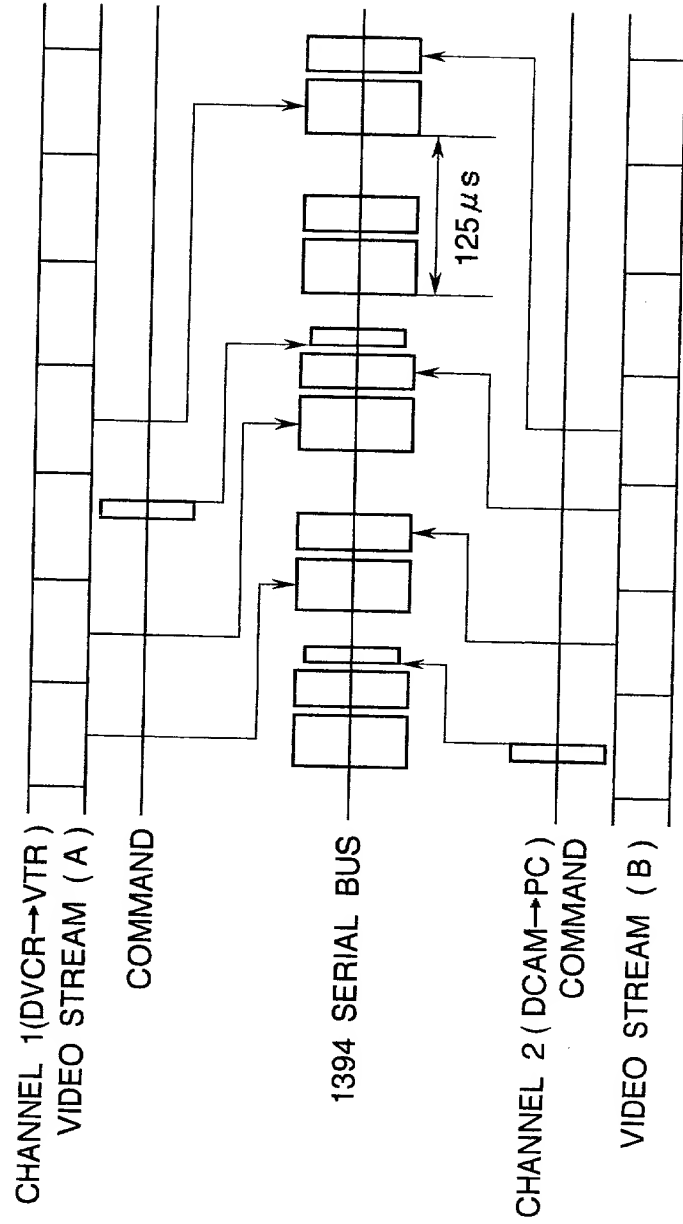


FIG.3

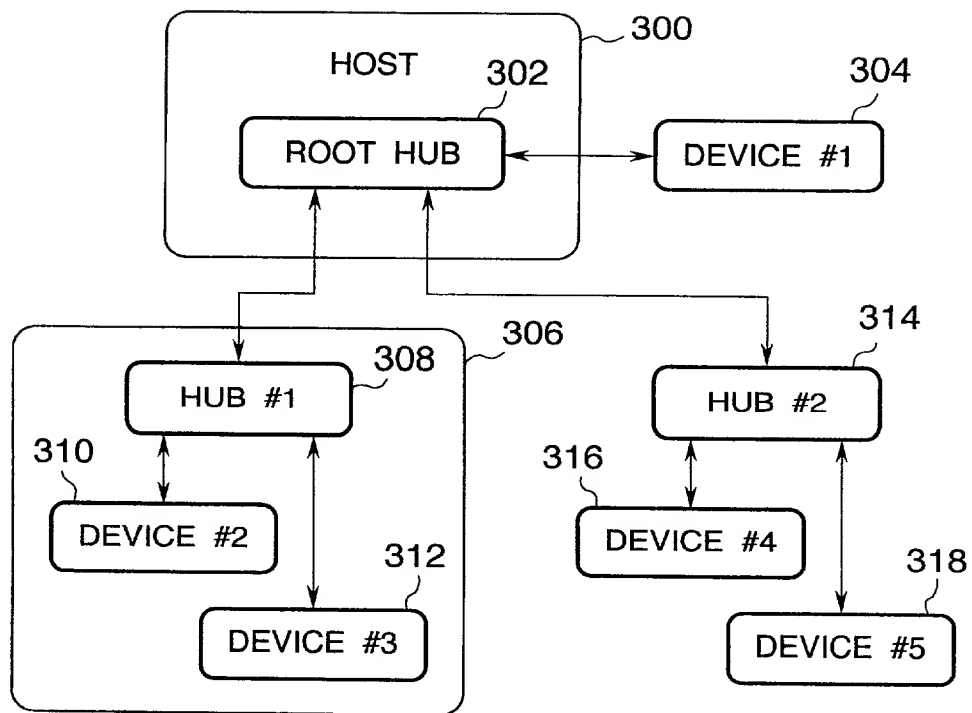


FIG.4

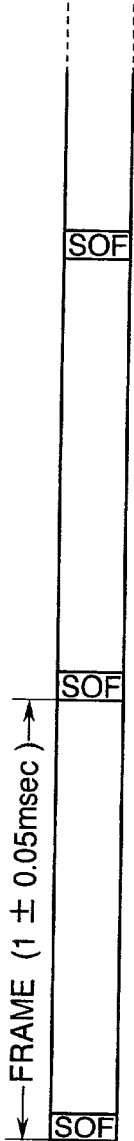


FIG.5A

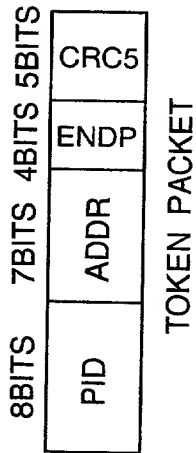


FIG.5C

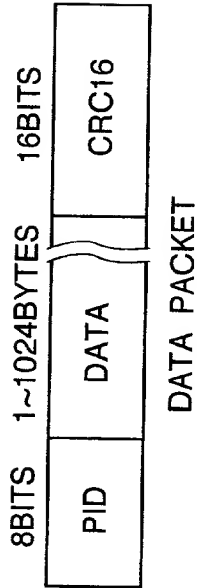


FIG.5B

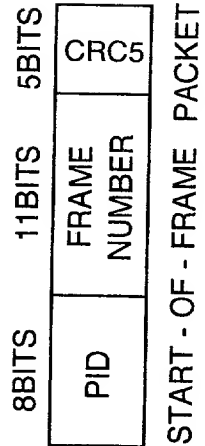


FIG.5D

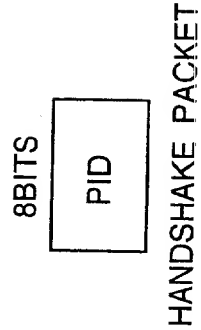
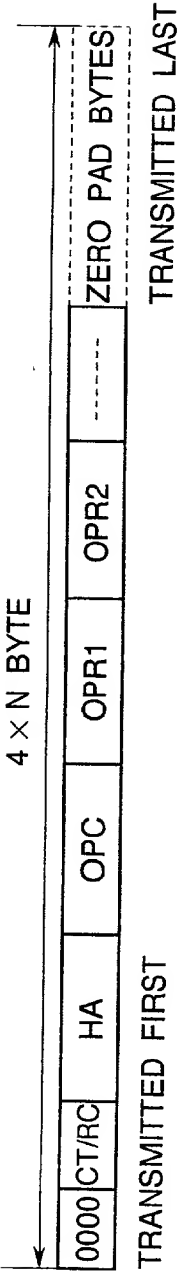


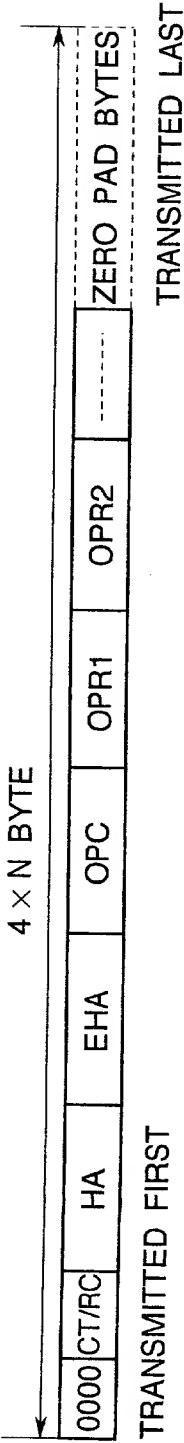


FIG.7A



FOR HA = 0 x 00 - 0 x F7, 0 x FF

FIG.7B



FOR HA = 0 x F8 - 0 x FE



FIG.9

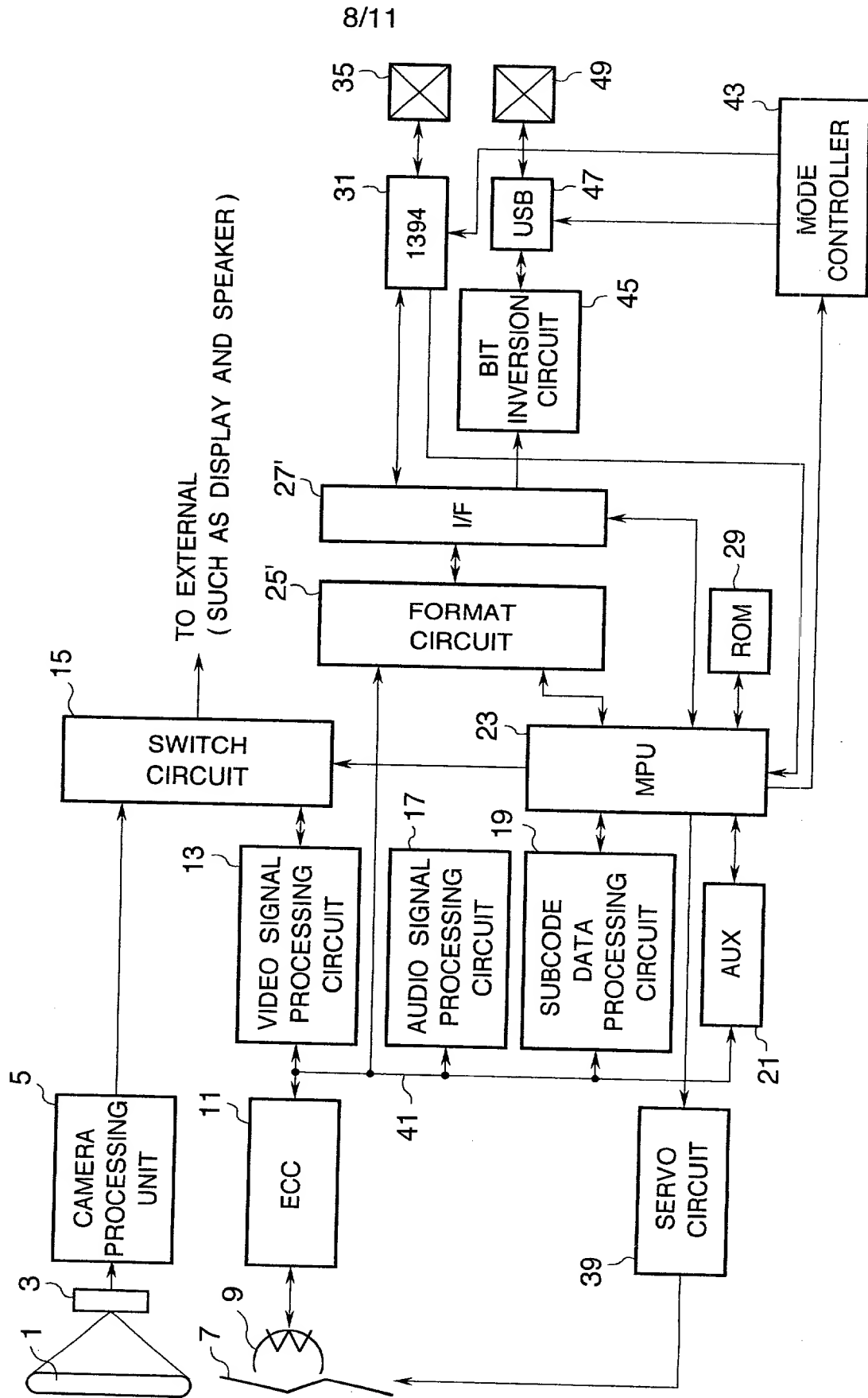


FIG.10A

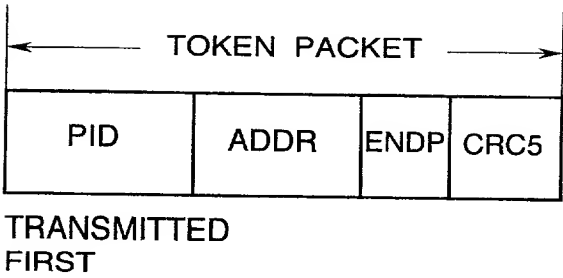


FIG.10B

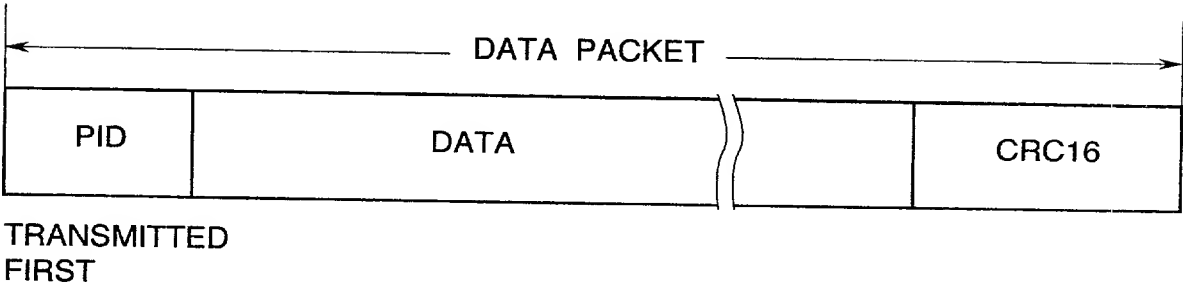
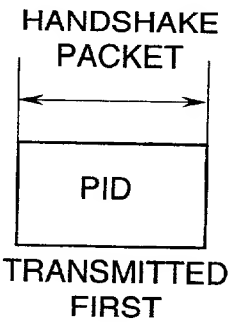


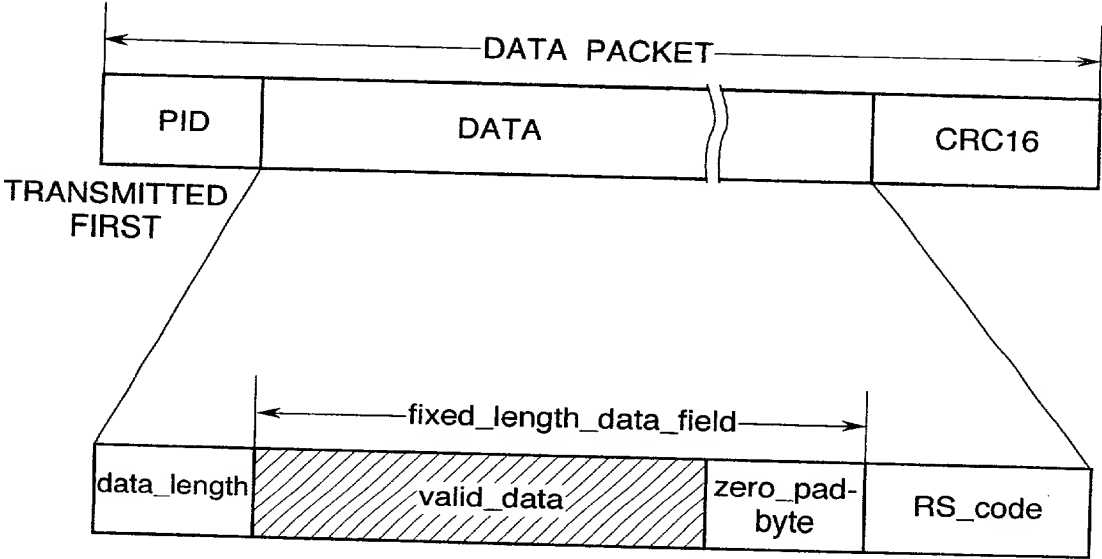
FIG.11



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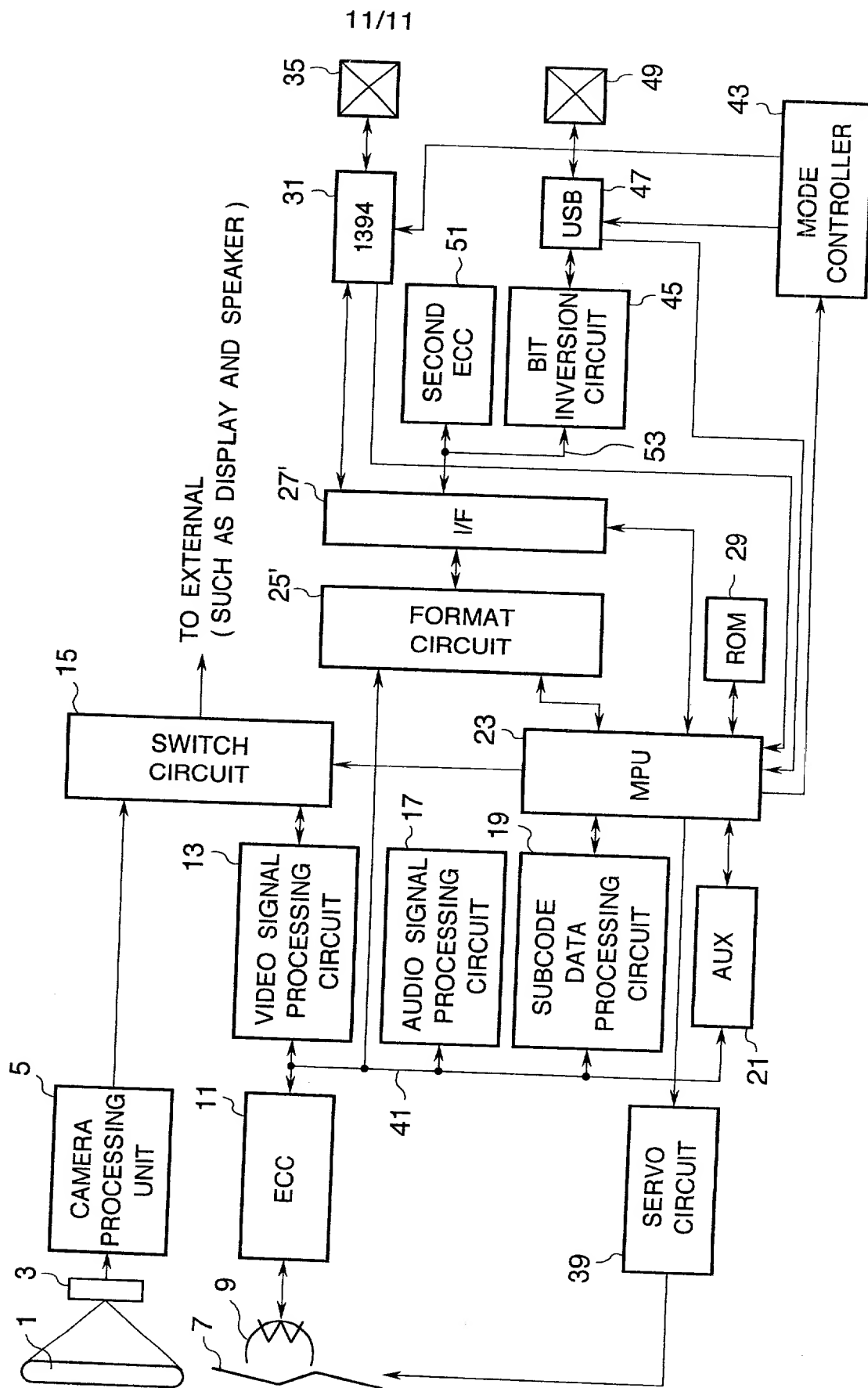


FIG.12

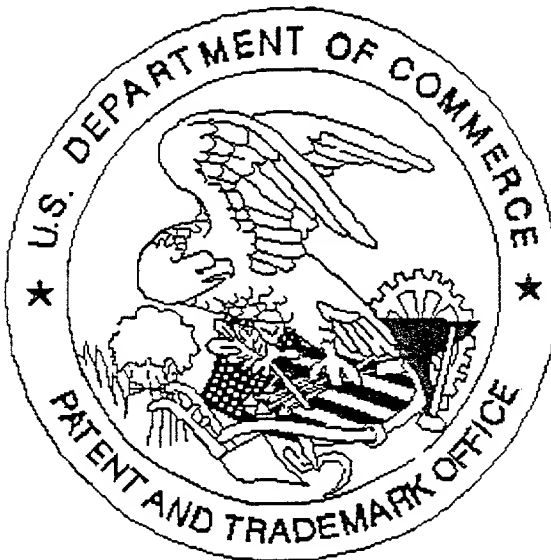


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FIG.13



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